

What is claimed is:

1. A solid polymer electrolyte membrane fuel cell electrode catalyst layer comprising:

catalyst particles carried on a catalyst carrier; and

5 a solid polymer electrolyte,

wherein a center-to-center distance dimension (L_{pt-pt}) between the catalyst particles carried on the catalyst carrier is made to substantially coincide with the sum of a double of a total dimension resulting by adding the length (L_{pes}) of a side chain having an ion-exchange group to the radius ($D_{pem}/2$) of a main chain of the solid polymer electrolyte and the diameter (D_{pt}) of the catalyst particle.

2. A solid polymer electrolyte membrane fuel cell electrode catalyst layer as set forth in Claim 1, wherein the diameter (D_c) of the catalyst carrier, the diameter (D_{pt}) of the catalyst particle, the radius ($D_{pem}/2$) of the main chain of the solid polymer electrolyte, the length (L_{pes}) of the side chain having an ion-exchange group and a catalyst carrying weight ratio (WR_{pt}) of the catalyst particle carried on the catalyst carrier are such as to substantially satisfy the following equation;

$$L_{pt-pt} = D_{pt} + 2(0.5D_{pem} + L_{pes}) = \sqrt{(2 \cdot \Delta Sc / 3 \tan 30^\circ)}$$

$$\Delta Sc = \pi \cdot \sigma_{pt} \cdot D_{pt}^3 / \sigma_c \cdot D_c (1 / WR_{pt} - 1) = \pi \cdot D_c^2 / N_{pt}.$$

3. A solid polymer electrolyte membrane fuel cell electrode catalyst layer as set forth in Claim 1, wherein the amount of the solid polymer electrolyte is such as to cover the catalyst particle substantially entirely.

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4. A solid polymer electrolyte membrane fuel cell electrode catalyst layer as set forth in Claim 1, wherein the catalyst carrier is a carbon carrier and the diameter (D_c) of the catalyst carrier is 30nm or smaller, wherein the catalyst
10 particle is a Pt particle and the diameter (D_{pt}) of the catalyst particle ranges from 0.6nm or greater to 2.0nm or smaller, and wherein a catalyst carrying weight ratio (WR_{pt}) of the catalyst particle carried on the catalyst carrier is 30 wt% or smaller.

15 5. A solid polymer electrolyte membrane fuel cell electrode catalyst layer as set forth in Claim 4, wherein the solid polymer electrolyte is formed from perfluorosulfonic acid.

20 6. A solid polymer electrolyte membrane fuel cell electrode catalyst layer as set forth in Claim 5, wherein the length (L_{pes}) of the side chain of the solid polymer electrolyte is 1nm or smaller, and wherein the length of a unit main chain of the solid polymer electrolyte is 3nm or smaller.

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7. A solid polymer electrolyte membrane fuel cell electrode catalyst layer as set forth in Claim 1, wherein a ratio of a total number of the ion-exchange groups in the solid polymer electrolyte which contact the catalyst particles relative to a total volume of the catalyst carrier is made to become maximum.

8. A solid polymer electrolyte membrane fuel cell electrode catalyst layer as set forth in Claim 7, wherein the catalyst carrier is a carbon carrier and the diameter (D_c) of the catalyst carrier is smaller than 30 nm, wherein the catalyst particle is a Pt particle and the diameter (D_{pt}) of the catalyst particle ranges from 1 nm or greater to 4 nm or smaller, and wherein the catalyst carrying weight ratio (WR_{pt}) ranges from 30 mass% or greater to 70 mass% or smaller.

9. A solid polymer electrolyte membrane fuel cell electrode catalyst layer as set forth in Claim 8, wherein the solid polymer electrolyte is formed from perfluorosulfonic acid.

10. A solid polymer electrolyte membrane fuel cell electrode catalyst layer as set forth in Claim 9, wherein the length (L_{pes}) of the side chain of the solid polymer electrolyte is 1 nm or smaller, and wherein the length of a unit main chain

of the solid polymer electrolyte is 3nm or smaller.